



## Free-flow Hydropower Systems

*NREL Industry Growth Forum – November 18, 2003*





# Free-Flow Hydropower System Economics

- Low Unit Costs (\$1,000 - \$1,500 per kW Installed)
- Low Operations & Maintenance Costs
- Competitive Pricing (< 7 Cents per kWh)
- Low Capital Costs
- Quick Construction
- Modular Design





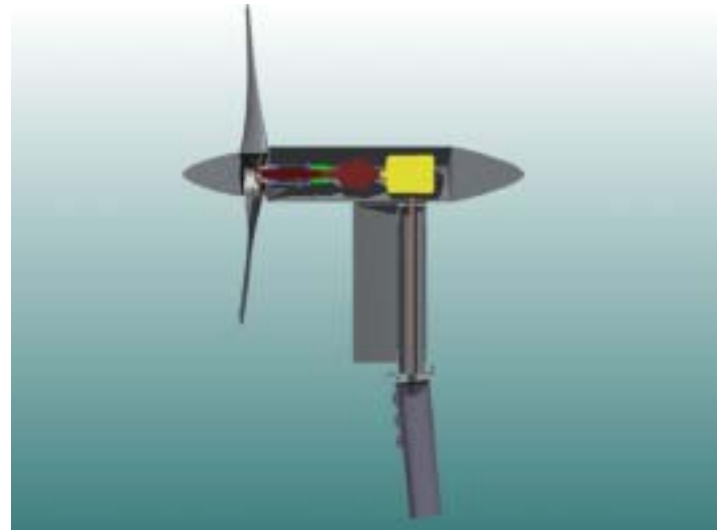
# \$90 Billion Global Market in Installations Alone

- Global Electricity Demand Increases 173% by 2020
  - *Energy Information Administration*
- Deregulation/Privatization, Technology Favor Small Hydro
  - *EIA / UN Council on Environment & Development*
- U.S. Capacity: 12,500 MW, 120 Sites, \$30 Billion
  - *New York University*
- Canada: \$31 Billion; Developing Countries: 1% = \$30 Billion
  - *Natural Resources Council of Canada; DOE/INEEL*
- Hydrogen Production, Purification, Desalinization, Irrigation



# Business Model Part I - Turbine System Developer

- No Dams or Civil Works
- Environmentally Benign
- Commercial & Proprietary Component Integration
- Obtained Government, Industry, NGO Support
  - DOE (INEEL, ORNL)
  - EPRI
  - NHA
  - TNS
  - ERT





# Turbine Systems - Illustration: East River

- Roosevelt Island, East River (Tidal Basin), NYC
- Successful Demonstration Completed January 2003
- 200 kW Commercial System Deployment in 6 Months
- 5 - 10 MW Field Completed in 3 Years
- Two \$500K Grants (\$1M Total) to-Date from NYS







# East River Site





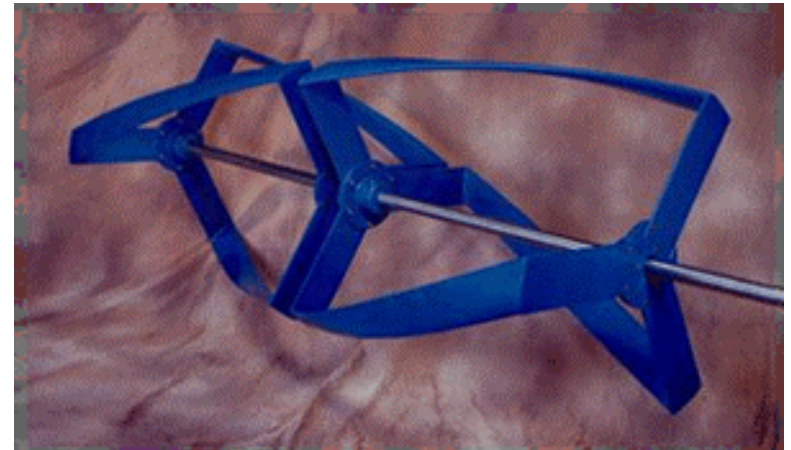
# Business Model, Part II – Systems Integrator

- Small-Scale Hydro Without Dams
- Systems Integration - “Water-to-Wire”
  - Identify & Analyze Sites
  - Determine Best Free-Flow Technology
  - Implement Full Solution
- The System Integrator Owns the Platform



# Systems Integrator - Illustration: Massachusetts

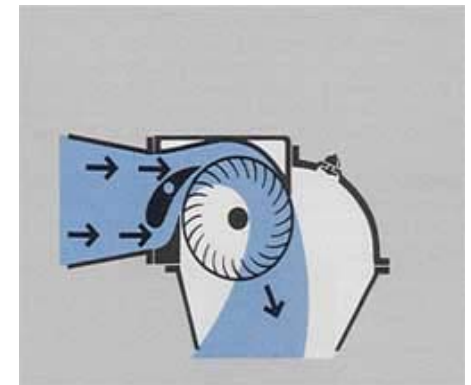
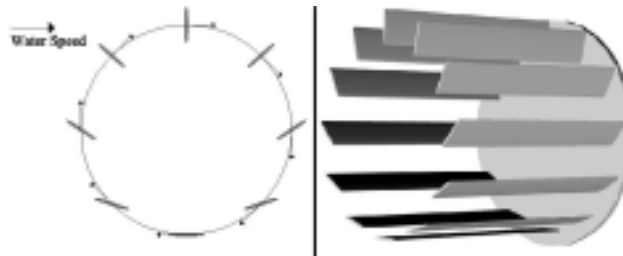
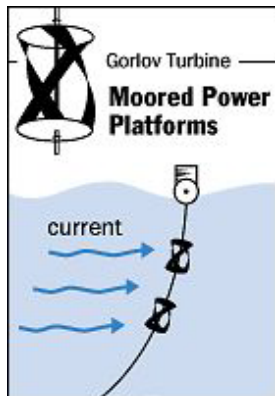
- Studies Commissioned by Electric Power Research Institute
  - Instream Energy Technology Report – 2002, 2003, 2004
  - Site Assessment and Deployment for Tennessee Valley Authority
- Verdant Power Integrates Multiple Technologies
  - Awarded \$500K Grant from MA for Verdant Platform, Gorlov Helical Turbine





# Competitors >> Partners

- GCK Technology - Gorlov Helical Turbine
- LEC, Inc. - Lehoczky Turbine
- Ossberger Low Head Turbine (Impoundment)
- Bosch Aerospace - Cycloidal Turbine



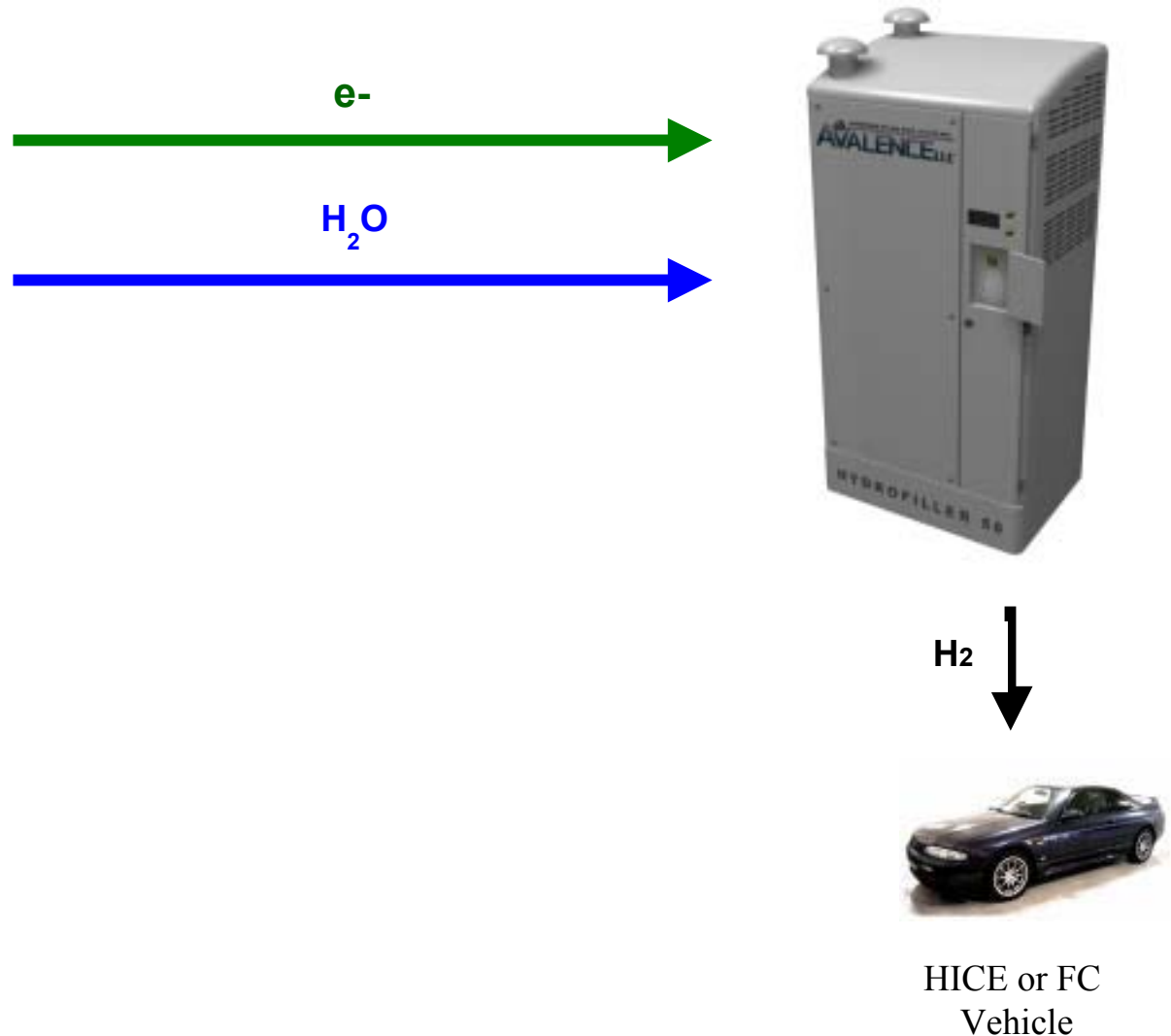


# Hybrid Configuration Today: Renewable Energy >> High Pressure Electrolyzer

## Verdant Turbine



## Avalence Hydrofiller

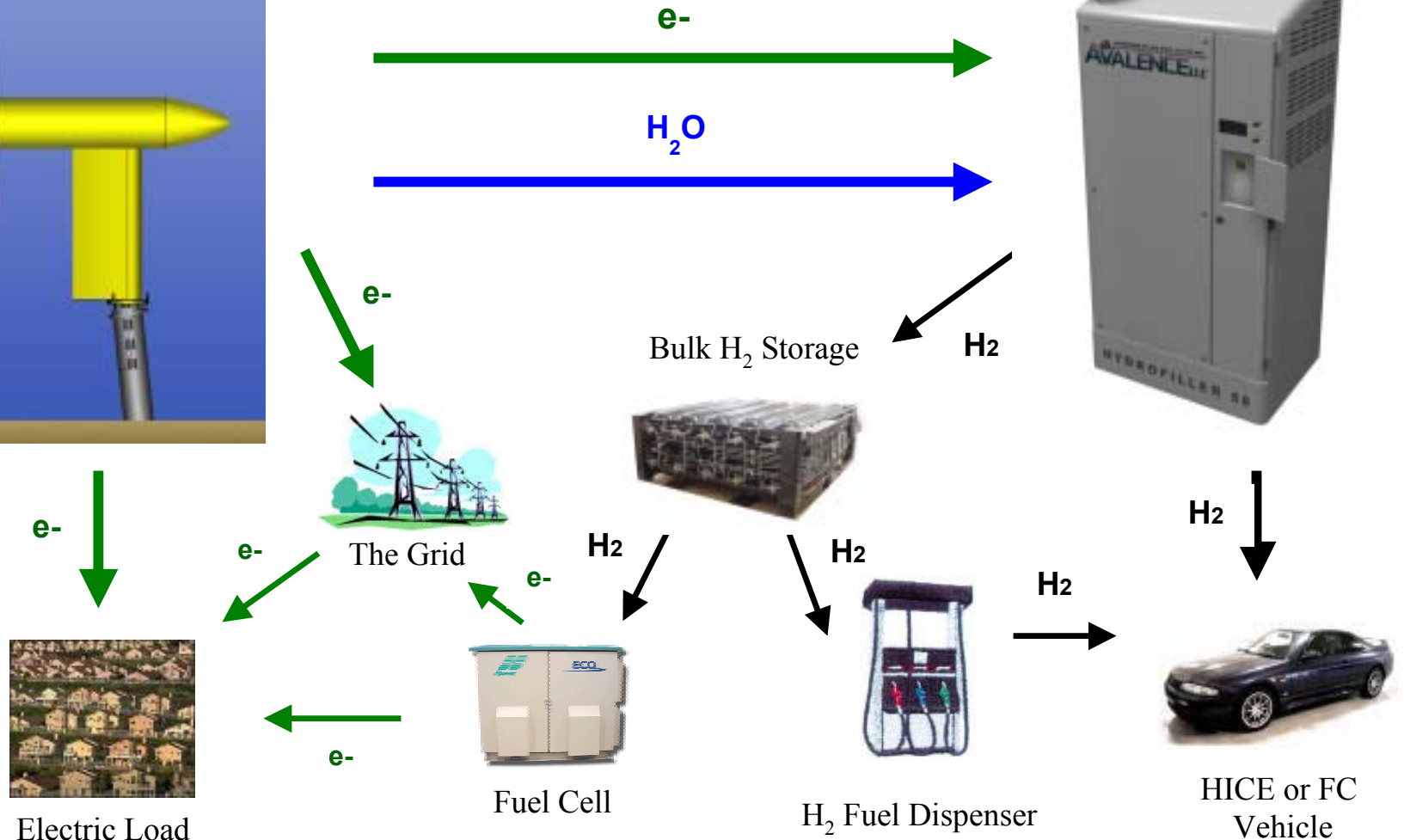


# Hybrid Configuration for Future Hydrogen Economy

## Verdant Turbine



## Avalence Hydrofiller

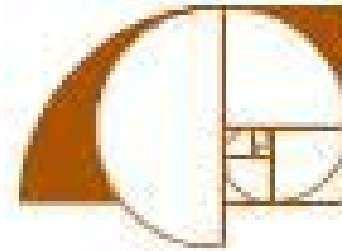




# East River Project Partnerships - Private, Public, NGO, Academic



**Environmental Resources Trust -**  
EcoPower program quantifies  
environmental benefits; works to  
catalyze green power market



**The Cooper  
Union For the  
Advancement of  
Science and Art;  
CU Research  
Foundation -**  
incubator for East  
River project

**First Commercial  
Distributed Generation Free-  
flow Hydropower Project in  
the World – East River, NYC**

**Ecologically Benign Clean  
Energy; Economic  
Development; Community  
Infrastructure; Health  
Benefits**

**NYSERDA -**  
economic  
development,  
ratepayer  
benefits, RPS  
compliance,  
clean energy  
for NYS

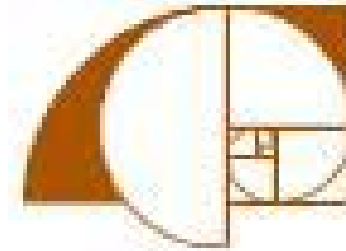


**Verdant Power –** Free-flow  
hydropower systems; renewable  
energy, economic development





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**Ecologically Benign Clean  
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Development; Community  
Infrastructure; Health  
Benefits**







# San Francisco Bay Partnerships - Private, Public, NGO, Academic



**Environmental Resources Trust -**  
EcoPower program quantifies  
environmental benefits; works to  
catalyze green power market



**The Natural Step -**  
Peer-reviewed,  
whole-systems  
framework to  
environmental and  
social sustainability;  
integrates long-term  
sustainability into  
strategic planning.



**California and San Francisco Bay –  
Abundant Physical Resources;  
Progressive Policy and Popular Support;  
\$100M Bond Measure Passed; Board of  
Supervisors Mandate Tidal Power**

**Energy Crisis; Current Dirty Generation  
Sited in Disenfranchised  
Neighborhoods; Aging Infrastructure;  
Health and Economic Development**

**Lawrence  
Berkeley Nat  
Laboratory -**  
Leader in  
science and  
engineering  
research in  
new energy  
systems and  
environmental  
solutions



**Verdant Power –** Free-flow  
hydropower systems; renewable  
energy, economic development





# San Francisco Bay Partnerships - Private, Public, NGO, Academic



*SF Environment*



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Abundant Physical Resources;  
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\$100M Bond Measure Passed; Board of  
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**Energy Crisis; Current Dirty Generation  
Sited in Disenfranchised  
Neighborhoods; Aging Infrastructure;  
Health and Economic Development**





# Leadership Team

- **Ron Smith: *Chairman & COO*** - Booz-Allen; Bendix; Harvard MBA; MS
- **Matt Klein, CFA: *CEO*** - Principal, Robertson Stephens, Founder, Equity Partnerships; ED, Charitable Foundation; Director, NGOs & Start-ups
- **Kevin Lynch, CPA: *CFO*** - Founder, Dieterle & Lynch; MS Taxation
- **Trey Taylor: *President*** - BGE; Price Waterhouse; EEI; P&G; ITT Corp.
- **Jameel Ahmad, PhD: *Senior Advisor*** - Professor and Chairman, Department of Engineering, The Cooper Union for the Advancement of Science and Art; Director, The CU Research Foundation, Fellow at Research Institute for the Study of Man
- **Dean Corren: *Director of Technology Development*** - NYU Scientist, 4-term Vermont Representative, Outreach Director for U.S. Representative
- **Gilbert Sperling: *Corporate Attorney*** - Former Senior Counsel, Energy Conservation and Power Subcommittee, U.S. House of Representatives
- **World-class Board of Directors and Board of Advisors**



# Capital Finance - Three Legs to the Stool

- Private Financing – Traditionally Only Path Available
  - Friends/Family, Angels, Private Equity/VC, IPO, Follow-on, M&A
- Public Funding
  - City, **State**, Federal, International
- NGO/Foundation/Academia Support
  - Teaming Arrangements with Cooper Union and CU Foundation, Environmental Resources Trust (dedicated staff member), The Natural Step, Others



# Capital Finance >> Project Finance

- History: \$4.7 Million Raised To Date
  - \$1.1M from 4 Principals; \$1.7M from Grants
- Short-term Need: \$700K of Current \$1.2 Million Raise
  - Operating Capital
  - Fabrication & Deployment of Commercial System in 6 Months
- Next: \$10M Financing/Grants for Scale Commercialization

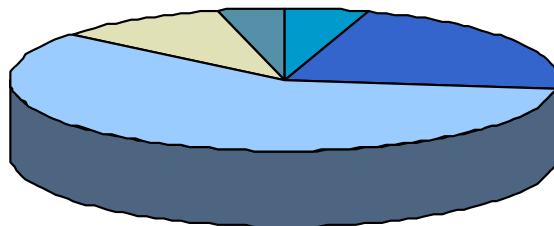




Capital Finance >>

# Revenue/Project Finance

- Consulting, Site & Resource Analysis
  - E.G. EPRI/TVA Commissioned Studies
- Integrated System Development
  - E.G. Verdant/Gorlov - Acquisition, Licensing, Reseller Agreement
- Verdant Power Turbine System Sales
  - E.G. East River: 10 MW \* \$1,500/kW = \$15M
- Power Production - Equity Retention in Sites
  - Power Purchase Agreements, **Renewable Energy Credits**, PTCs
- Maintenance and Upgrades

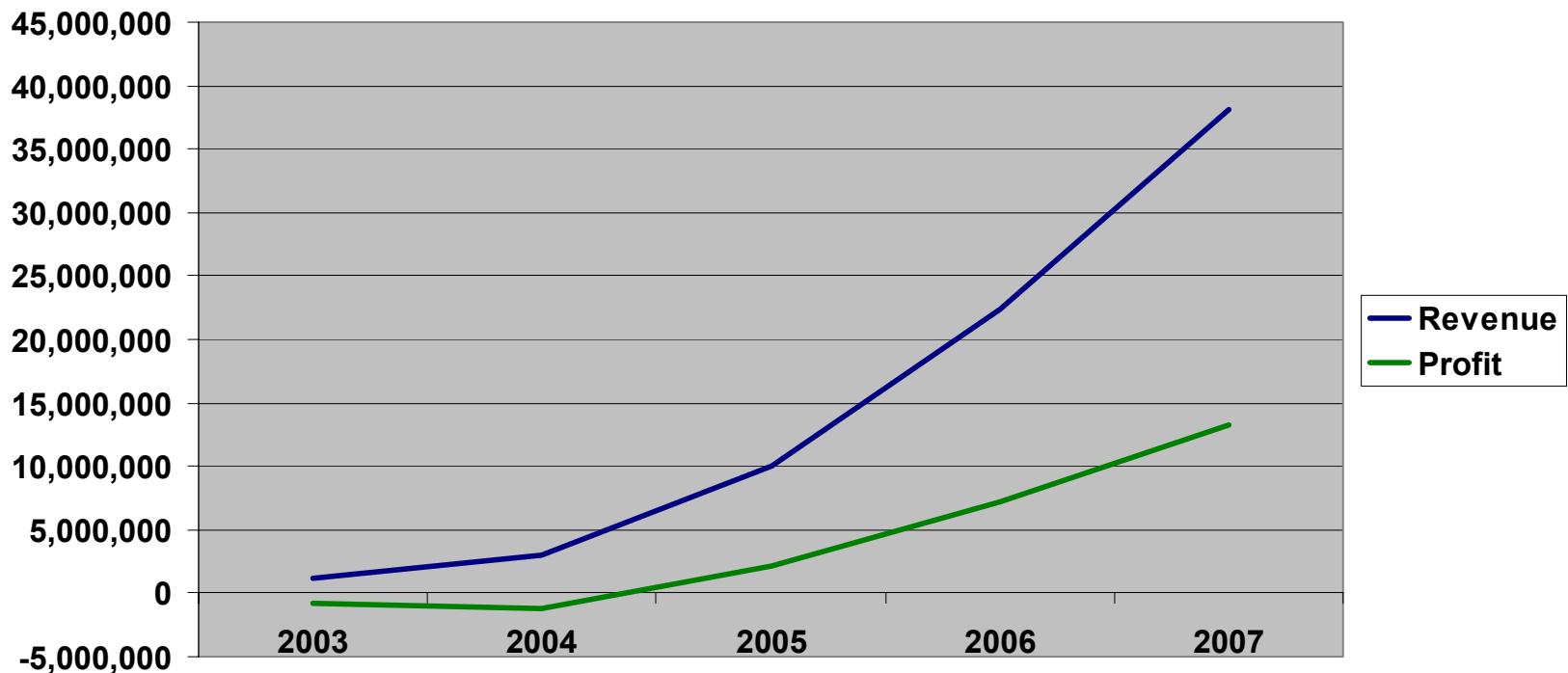


- Consulting: 5%
- Integrated Systems: 10%
- Proprietary Systems: 40%
- Green Power: 40%
- Upgrades: 5%



# Revenue Projections

- \$37 Million by 2007 (10 Concurrent Sites)
- 30% Growth / 50% Gross Margins





# Summary

- Strong, Experienced Management Team
- Innovative Financing Strategy
- Market Leader
- Huge Market
- Systems Integrator Business Model
- Proven Track Record of Success
- First Commercial Distributed Generation Free-flow Hydropower in the World in 6 Months